

A study of permeability and tortuosity of concrete

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Abstract:

Permeability of concrete is commonly used as a key index for assessing the durability of concrete, especially when concrete is to be exposed to the aggressive environment. For a porous material like concrete, permeability depends on porosity and pore characteristics such as pore size, orientation, connectivity, and size variation. The effects of porosity and pore characteristics on permeability can be captured through a single parameter called tortuosity. Thus, tortuosity can also be viewed as an alternative index for concrete durability.

In the present study, laboratory tests were carried out to measure permeability and tortuosity for different concrete mixes. A set-up, developed on the principle of Darcy's equation, was used for measuring permeability. Gas diffusion tests, PHI-220 Helium Porosimetry tests and Mercury Intrusion Porosimetry (MIP) tests were conducted for determining the tortuosity. Test results were used to study the variations of permeability and tortuosity with the key mix parameters such as water/cement ratio and cement content. A plot of tortuosity versus permeability values has indicated the existence of a typical relationship between tortuosity and permeability. Results show that higher the tortuosity, lower is the permeability.